

# Meta Analysis on Conventional Versus Digital Implant Impressions in Full Mouth Rehabilitation Cases

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**Abstract:** *Statement of problem: Evidence comparing conventional versus digital implant impressions in full mouth rehabilitation cases. Purpose: The purpose of this systematic review and meta-analysis was to compare the duration of making impressions in conventional versus digital implant cases in full mouth rehabilitation. Material and method: This systematic review and meta-analysis have been conducted according to PRISMA (Preferred Reporting of Items for Systematic Review and Meta-Analyses) protocol and PICO (Population Intervention Comparison Outcome) study design. Heterogeneity was evaluated, and meta-analyses were performed in the selected articles. Results: the database search resulted in 614 articles. After removing duplicate articles, the titles and abstract were screened in detail and 8 articles were selected for quantitative and qualitative analysis according to the eligibility criteria. Overall, conventional impressions showed greater time than digital impression. A mean difference of 4.43 minutes was found, making digital impressions beneficial at  $p < 0.001$ , which was highly significant. The study reported heterogeneity of 96%, suggesting wide variance amongst the studies. In order to accommodate for heterogeneity, a random effect model was employed. Conclusion: conventional impressions showed greater time than digital impression in implant cases in full mouth rehabilitation.*

**Keywords:** Implant Impressions, Digital versus Conventional Implant, Full Mouth Rehabilitation, Meta-Analysis, Conventional Implant Impression

## 1. Introduction

With the last few decades witnessing the great advancements in the field of medicine and dentistry, dentistry has improved techniques that have led the clinicians to have new materials and techniques helping them to improve the quality of life of the patient. With this, the world shifts its focus from conventional techniques to digital. Also, as the world witnesses the global pandemic, turning digital was of great emphasis. Digital impressions techniques have had a widespread use in India and the world abroad. Digital implant impression techniques hold great advantages in the full mouth rehabilitation cases over conventional prosthetic approaches and enabled completely new treatment workflows, as well as introducing the concept of the "virtual patient, as it enables to transform the patient into a virtual model which reduces the dentist-patient exposure, decreasing the risk factor and increasing the comfort of the patient, improving productivity and decreasing the material consumption.

Conventional impression technology was developed in the year 1900s, and with the development in newer technologies developed in the last few years, dental materials have also evolved with time. <sup>(1)</sup>Conventional dental impression includes taking impression with the use of stock or custom trays depending upon the impression to be taken. The tray is filled with impression material and inserted into patient's mouth and is held until the impression sets in few minutes. When the operator observes that the material has reached its sufficient hardness, the tray is removed from patient's mouth with extreme care so that the impression does not distort. Later, the cast is poured and the dental technician receives the cast, which is the proper replica of the patient's anatomical gums and teeth.

Recently, with digital revolutionization, dentistry has seen development with digital technology for impression making with the help of intraoral scanners machinery. These

intraoral scanners are a three-dimensional device which detects dental impressions, through first acquisition of images and then processing it with the help of software. Dr Francois Duret, in the era of 70s, hypothesized the possibility of acquiring data through digital technology; later on, in the year 1983, he produced a dental crown with the help of CAD software, and hence, is also considered as the father of modern digital dentistry. The intraoral scanners should maintain minimum error possibilities. The pros of digital technology in dentistry regarding the impression technique is patient comfort, less time consumption, higher chances of highlighting any errors and educating the patient regarding the outcome of the treatment in the first visit. This technology can be used in any type of treatment ranging from complete dentures to fixed prosthesis to orthodontics and teeth requiring treatment for caries or implants.

The comparison of conventional and digital implant impression has been argued upon and well documented.

### 1.1 Aim

This study evaluates the efficiency of time between digital versus conventional impressions for implant placement. (Measured in minutes)

## 2. Material and Methods

### 2.1 Protocol and Registration

This systematic review and meta-analysis have been conducted according to PRISMA (Preferred Reporting of Items for Systematic Review and Meta-Analyses) protocol and PICO (Population Intervention Comparison Outcome) study design.

The PRISMA Statement recognizes the dynamic nature of this process and guarantees a correct assessment of the

quality of the systematic review, following a path suitable for analysing the included studies.

**2.2 Exclusion and Inclusion Criteria**

**Exclusion**

- In vitro studies
- Lab analysis
- Animal studies
- Single studies
- Studies not in English language

**Inclusion**

- Digital impression technique study
- Conventional impression technique study
- On human study
- Randomized Controlled Trial (RCT) or Clinical Trial (CT)
- Last 10 years study

**2.3 Search Strategy**

The results for this systematic review have been extrapolated by the most important academic and scientific information sources as Pubmed, Google Scholar, Cochrane Review, Elsevier, Web of Science and Hand searches in order to obtain the highest number of results possible.

Search terms used on information sources were: “(digital [All Fields] AND impression [All Fields] AND technique [All Fields]) AND ((Randomized Controlled Trial [ptyp] OR

Clinical Trial[ptyp])AND “loattrfull text”[sb] AND “2011/11/08”[PDat]: “2021/11/05”[PDat])”.

These keywords have been elaborated by authors in order to lower risk of bias and to obtain a high number of results.

**2.4 Study Selection**

The focus question of the systematic review of PICO (Population Intervention Comparison Outcome) study design is:

- P: Population: Edentulous and partially edentulous patients
- I: Intervention: Digital impression technique.
- C: Comparison: Conventional impression technique.
- O: Outcome: Time effectiveness

**2.5 Risk of Bias in Individual Studies**

Author and year	Risk of bias			
	Unclear	Low	Moderate	High
Zitzmann et al. 2017		X		
Sailer et al. 2019			X	
Capparè et al. 2019			X	
Joda et al. 2017			X	
Gherlone et al. 2016		X		
Benic et al. 2016		X		
Gjelvold et al. 2016		X		
Yuzbasioglu et al. 2014			X	

Table 1.1: Risk of Bias In Individual Studies

**Meta Analysis**

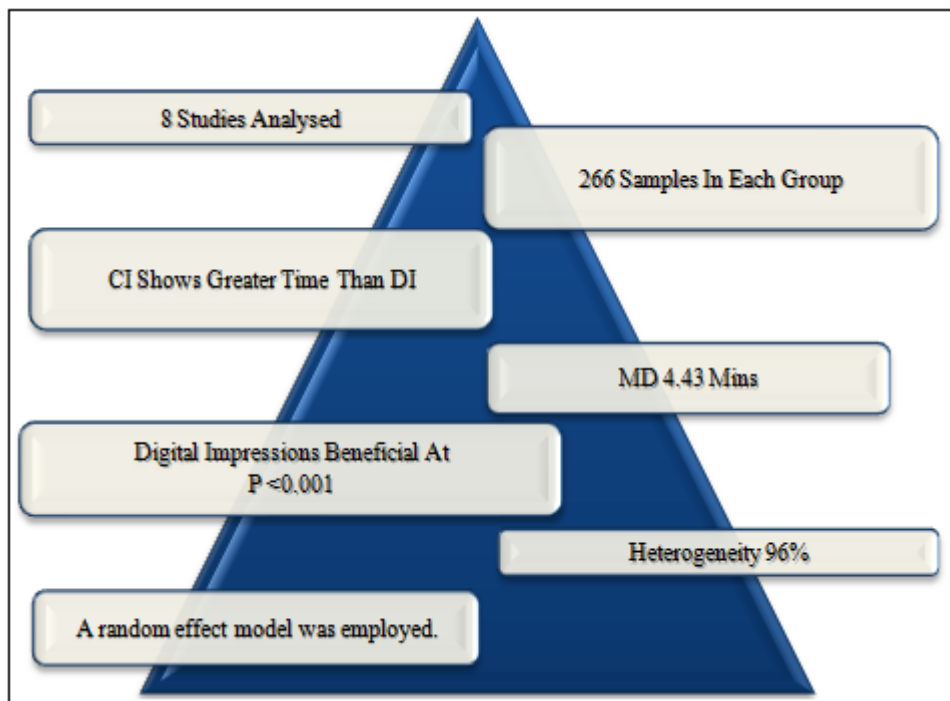


Table 1.2: Main outcome of the selected results

STUDY	PARAMETER COMPARED	MAIN OUTCOME
Yuzbasioglu et al	Time, Patient Perception	DI Preferred
Gherlone et al	Time, Accuracy	DI Preferred
Gjelvold et al	Difficulty, Time	DI Preferred
Benicgi et al	Impression Difficulty, Time Operator Comfort	CI Preferred

<b>Sailer et al</b>	Time, Patient & Operator Perception	CI Preferred
<b>Zitzmann et al</b>	Level Of Difficulty, Efficiency of Intraoral Scanning, Time	DI Preferred
<b>Cappare et al</b>	Time, Accuracy	DI Preferred
<b>Joda t et al.</b>	Time Efficiency, Operator Difficulty, Operator Preference	DI Preferred

**2.6 Summary Measures**

According to selected studies, some measure could be compared.

Main outcome of the selected results is showed in table 1.2

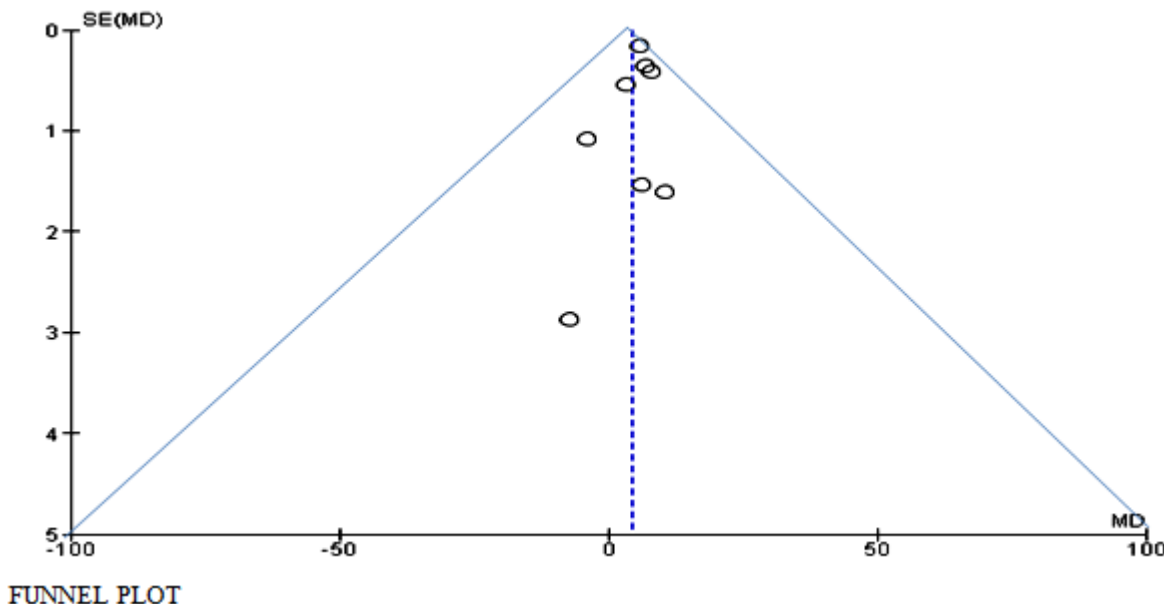
Study or Subgroup	Conventional			Digital			Weight	Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total			
Emir Yuzbasioglu et al	10.08	0.39	12	4.14	0.39	12	15.3%	5.94 [5.63, 6.25]	
Gherlone et al	18.23	5.38	15	7.57	3.08	15	10.5%	10.66 [7.52, 13.80]	
Gjevoid et al	20.42	5.42	24	14.33	5.27	24	10.7%	6.09 [3.07, 9.11]	
Goran I Beric et al	4.33	1.1	10	8.21	3.23	10	12.7%	-3.88 [-5.99, -1.77]	
Irene Sailer et al	10.96	2.51	10	18.18	8.71	10	6.2%	-7.22 [-12.84, -1.60]	
Nicda Zitzmann et al	12.04	0.2	25	5.02	1.76	25	15.1%	7.02 [6.33, 7.71]	
Paolo Cappare et al	16.45	4.49	150	8.59	2.46	150	14.9%	7.86 [7.04, 8.68]	
Tim Joda et al	17.9	1.1	20	14.8	2.2	20	14.6%	3.10 [2.02, 4.18]	
<b>Total (95% CI)</b>	<b>266</b>			<b>266</b>			<b>100.0%</b>	<b>4.43 [2.63, 6.23]</b>	

Heterogeneity: Tau<sup>2</sup> = 5.48; Chi<sup>2</sup> = 169.59, df = 7 (P < 0.00001); I<sup>2</sup> = 96%  
 Test for overall effect: Z = 4.82 (P < 0.00001)

**Forest Plot**

**Interpretation:** A total of 8 studies were analysed, with 266 samples in each group of conventional and digital impression assessed. Overall, conventional impressions showed greater time than digital impression. A mean difference of 4.43 minutes was found, making digital impressions beneficial at p < 0.001, which was highly significant.

The study reported a heterogeneity of 96%, suggesting wide variance amongst the studies. This could be attributed to different sample sizes, laboratory conditions and physiological differences. In order to accommodate for heterogeneity, a random effect model was employed.



**Interpretation:** No publication bias was noted. Dots represent studies, confined to the funnel

**3. Discussion**

In a Randomized Controlled Trial, Zitzmann et al. assessed the difficulty level in the use of both digital and conventional impression techniques. The inexperienced students preferred digital implant impression techniques

easier.<sup>(2)</sup> According to a Randomized Controlled Trial done by Sailer et al, the chair side time and preferred techniques were assessed. The individuals chose digital technique over conventional methods.<sup>(3)</sup> According to Cappare et al, evaluation was based on accuracy and predictability of the techniques, results showed that digital method showed more reliability for full mouth rehabilitation cases with better marginal fit<sup>(4)</sup>. In a study by Joda et al, the dental operator and students' groups were selected to demonstrate that scanning digitally is more efficient than the traditional method for single implant impressions<sup>(5)</sup>. Gjervold et al assessed the parameters of efficiency and convenience of both the techniques and came to a conclusion that digital method was more efficient and convenient.<sup>(6)</sup> Gherlone et al in a study concluded that the accuracy of impressions is more in full mouth rehabilitation done by digital impression technique<sup>(7)</sup>. In a study by Benic et al, traditional method was preferred over digital implant impression technique on the parameters of time and patient discomfort.<sup>(8)</sup> Yuzbasioglu et al concluded that digital technique for impressions is more time efficient and patients also preferred the same.<sup>(9)</sup>

Digital impressions holds greater advantages over the conventional impressions as it is easier for the patient to understand the outcome of the treatment during the initial visit and also less discomforting for the patient, no material manipulation, chair side time is reduced, hence working efficiency increases, eventually reduces no. of appointments and allows the formation of a soft tissue emergence profile, similar to that of definitive crown.

#### 4. Limitations

The main limitation of the study is the low number of works evaluated, despite the fact that almost all of them have agreed results.. The only comparable numerical data was that of time. Certainly, further studies will be necessary, and useful to obtain more precise information about these techniques, which over time, will replace the analog ones.

#### 5. Conclusion

- 1) Both digital and conventional were having difficulty on different impression techniques.
- 2) Digital technique improves
  - Chair time.
  - Accuracy.
  - Predictability.
  - It is a reliable alternative for full arch rehabilitations with a marginal fit precision

#### Author Contributions

Conceptualization, Dr Palak Mishra, Dr Swapnil Parlani, Dr Shreyans Damade; Methodology, Dr Palak Mishra, Dr Sahana Shivakumar, Dr Swapnil Parlani; Software, Dr Palak Mishra, Dr Sahana Shivakumar; Validation, Dr Palak Mishra, Dr Swapnil Parlani, Dr Shreyans Damade; Formal Analysis, Dr Palak Mishra, Dr Sahana Shivakumar; Investigation, Dr Palak Mishra, Dr Swapnil Parlani, Dr Sahana Shivakumar, Dr Shreyans Damade; Resources, Dr Palak Mishra, Dr Swapnil Parlani, Dr Sahana Shivakumar,

Dr Shreyans Damade, Data Curation, Dr Palak Mishra, Dr Swapnil Parlani, Dr Sahana Shivakumar, Dr Shreyans Damade; Writing—Original Draft Preparation, Dr Palak Mishra; Writing—Review And Editing, Dr Palak Mishra, Dr Swapnil Parlani, Dr Sahana Shivakumar, Dr Shreyans Damade; Visualization, Dr Palak Mishra, Dr Swapnil Parlani, Dr Sahana Shivakumar, Dr Shreyans Damade; Supervision, Dr Swapnil Parlani, Dr Sahana Shivakumar, Dr Shreyans Damade; Project Administration, Dr Palak Mishra, Dr Swapnil Parlani, Dr Sahana Shivakumar, Dr Shreyans Damade. All authors have read and agreed to the published version of the manuscript.

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